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And upwards, through transparent darkness gleaming,
 Gaz'd, in mute reverence, Woman's earnest eye,
 Lit, as a vase whence inward light is streaming,
 With quenchless faith and deep love's fervency,
 Gathering, like incense round some dim veiled shrine,
 About the Form, so mournfully divine !

Oh ! let thine image, as e'en there it rose,
 Live in my soul for ever, calm and clear,
 Making itself a temple of repose,
 Beyond the breath of human hope or fear !
 A holy place, where, through all storms, may lie
 One living beam of dayspring from on high !

F. H.

THE PRIMITIVE STATE OF THE GLOBE, AND ITS SUBSEQUENT CHANGES.

BEING A CONTINUATION OF THE LIFE AND WRITINGS OF THE LATE
 RICHARD KIRWAN, LL.D. &c. &c. BY JOHN O'REARDON, ESQ. M.D.

Having in a former number alluded to the works of Mr. Kirwan on the variations of the atmosphere, I now come to his elaborate treatises on "The Primitive State of the Globe, and its subsequent Catastrophes," published in 1796. It is divided into three essays. In the first essay, which treats on the primeval state of the globe, he endeavours to prove "that the solids that at present compose the earth, were soft, or in that state of minute division which aqueous solution requires ; and that by the successive crystallization of quartz, felspar, mica, tourmaline, &c. the primitive mountains were formed ; that before the existence of any fish there necessarily were stony masses inclosing the basen of the sea, in all of which carbonate of lime is found ; and that Buffon and Hutton erred in attributing to shell-fish the formation of all calcareous earth ; that the credit due to Moses' history is established on mere philosophic grounds, abstracted from every theological consideration : " in proof of which he has given "seven or eight geological facts, related by Moses on the one side, and on the other deduced," as he says, "solely from the best verified geological observations, and yet agreeing perfectly with each other, not only in substance, but in the order of their succession." It is, in the author's own words, "the coincidence of two accounts, derived from sources totally distinct from, and independent on, each other."

The second essay being on the Deluge, goes to refute the various hypotheses advanced to disprove a general inundation. Our countryman shows, that "exclusive of the confirmation of Moses' testimony, by the tradition of many ancient nations, (which may be seen in Grotius de Veritate, Huet. Quest. Alret. lib. ii. chap. xii. Euseb. Prop. Evang. lib. xii. &c.), there are some geological facts which," in his judgment, "prove it conclusively: such as marine shells discovered on Mount Perdu, the loftiest of the Pyrenees, at the height of nearly ten thousand feet ; the petrified bones of land animals found at the same elevation ; and both petrified shells and wood imbedded in a rock on a mountain of Peru ; other collections of shells known to belong to shores under climates very different from each other, found mixed promiscuously ; the accumulated bones of elephants and rhinoceri, surrounded by genuine marine vegetable ; and even the entire unputrefied carcass of a rhinoceros found at the distance of several hundred miles from the sea, in the lower parts of Siberia, which," according to his opinion, "was always too

cold for the habitations of these animals." Our author's arguments in proof of a general deluge are susceptible of additional corroboration, by a more extensive and varied enumeration of fossil animals and vegetables, such as is amply furnished by the present advanced state of the science. Of these some of the leading instances are here briefly sketched, namely:—the great Mastodon, an extinct genus of an immense fossilized animal from the banks of the Hudson's river, and from those of the Ohio and Mississippi, in North America, and also from the vicinity of the river Trawad in Asia, in south latitude 21° ; another species of Mastodon, discovered by Baron Humboldt, in the kingdom of Quito in South America, at the height of twelve thousand toises—the greatest elevation, it is believed, at which the fossil bones of quadrupeds have ever been observed: the fossil Elephant, different in species from its living type, extremely abundant in various climes and countries far distant from its present natural places of birth and abode, viz.—in Italy, France, Holland, Germany, England, Siberia, the north-western part of America, near to Behring's Strait, and even in the Arctic-icebergs, entangled in which lieutenant Kotzebue lately discovered the teeth and bones of this animal: the Siberian Mammoth, a species of the elephant, detected in 1803–4, in the snow of the most northern part of Siberia, with its muscles and integuments preserved by the intensity of the cold of the continual snow of that hyperborean region. The fossilized tusks, teeth, and femoral bones of the hippopotamus, rhinoceros, and hyæna, promiscuously mingled with those of the elephant and *ursus spæleus*, and other diluvial animals, in gravelly soil and diluvial earth, as well as in the caverns of calcareous rocks in nearly all the countries last mentioned: the *Elasmotherium*, a genus of mineralized animal of Siberia, constituting an intermediate link between the horse and rhinoceros: the gigantic fossil Tapirs found principally in France, of which one species is considered by Cuvier to have been equal in height and length to the elephant, and the great American Mastodon: the *Lophiodons*, (crested teeth,) a family of antideluvian animals whose osteology indicates evident affinities with the Tapirs and Rhinoceri, and in some respects with the Hippopotamus: the *Palæotherium* magnum of Cuvier—disengaged out of a bed of gypsum near Montmartre—one of the most interesting relics of the ancient world, and looked upon, from the structure of its skeleton, as intermediate between a Tapir and a horse, while it has a small orbit indicative of the stupid aspect of the hog: the *Palæotherium minus*, of the same locality, somewhat larger than a roebuck, with light and slender limbs: the *Anoplotherium*, or unarmed wild beast, so denominated by Cuvier in consequence of the shortness of its canine teeth: a similar animal of great size, exhumed from the Paris gypsum: the skeleton of the Irish Elk, or moose-deer, detected in some of the marly tracts in Ireland—a remarkable animal, whose head and branches are described by Molyneaux as measuring ten feet ten inches between the tips of the two horns; the remains of the red deer once found in marl by the late Mr. Edgeworth.

Ichthyolites, or fossil fish, extremely numerous and various throughout many parts of the globe, in all levels and at every altitude, in slaty rocks, in mountain limestone, in some chalk beds, and in argillaceous deposits, namely, the skeletons of the shark-ray, file fish, sun fish, globe fish, flying fish, pike, herring, cod, mackerel, bullhead, perch, eel, dory, &c. &c., lodged between, and impressed on the tablets of schistous rocks; fossil shells, both bivalve and turbinate, lying in considerable numbers promiscuously together in beds of sand and gravel on a blue-clay stra-

tum, over a tract of forty miles in length, from the vicinity of London to Suffolk, and through a great part of Norfolk : similar shells, and other animal exuviae found enclosed between alternate strata of green sand and slate-clay in the caribaxi cliffs on the left banks of the Brahm Putra river in Bengal ; in which cliffs there likewise have been detected the teeth, vertebræ, and fin-bones of sharks, together with a vertebra, femur and teeth of a crocodile, and the dorsal and pectoral fins of a *Balistes* : immense numbers of zoophytes, madrepores, and millepores, and testacea, so plentifully imbedded in mountain and transition limestone and in marble, as to induce some naturalists to believe such calcareous formations to be the products of these animals : vast multitudes of the amphibious class, of the higher orders of animals, including oviparous reptiles, both marine and herbivorous, viz.—an aquatic Salamander of gigantic size and unknown species, disinterred from the quarries of Aeningen : the great Saurian or Lizard family comprising many genera or species of amphibious creatures, detected in some of the limestone and lias oolite of many parts of England as well as of Germany, and also in the gypsum of Montmartre and of its neighbouring hills ; the Crocodiles of England, Germany, France, and other countries—of which six species are enumerated by Baron Cuvier—all different from the living crocodiles, and varying from each other : the *Ichthyosaurus* or fish-lizard, a singular reptile, a marine quadruped nearly resembling the crocodile in its mode of dentition and in the osteology of its head, but approximating in some particulars to the form of fish, discovered in lias quarries in Dorsetshire, Somersetshire, Gloucestershire, and Leicestershire, of a length varying in different specimens of this monster from twenty-four to thirty-six feet ; the *Plesiosaurus*, a remarkable monstrous inhabitant of the old world, exhumed a few years ago out of the lias in the vicinity of Bristol, the name of *Plesiosaurus* having been selected for it as expressive of its near approach to the saurian order, and particularly to the genus *Crocodile*, constituting a link between it and the *Ichthyosaurus*, yet receding from them in many important characters, especially in the form of its paddles, which present the joint structure of the feet of quadrupeds and the fins of fishes ; the *Megalosaurus*, an immense reptile of the saurian family, of about fifty-four feet in length, bearing a resemblance to the Monitor and to the *Lacerta gigantea* of the environs of Manheim ; this last mentioned lacerta, being intermediate between the crocodiles and monitors, has been styled *Geosaurus* by Baron Cuvier : the exuviae of maine turtles, and of a species of lizard of enormous size detached from chalky hills in the vicinity of Mæstricht ; also a fossil turtle disengaged not very many years ago from a quarry in Dorsetshire ; the *Iguanodon*, a fossil herbivorous reptile of the saurian tribe, supposed from the structure of its teeth to have inhabited rivers and fresh water lakes : skeletons of a small cetaceous animal, dug some years ago out of the harbour of Antwerp : relics of some small animals of the frog and toad kind, discovered in the quarries of Aeningen, from one of which quarries the above mentioned gigantic Salamander was detached : all amounting to about ninety-four species of quadrupeds, mammiferous, or oviparous—of which upwards of seventy are extinct from among the living inhabitants of the earth ; exclusively of the great profusion of fossil shell-fish and twenty species of zoophytes, consisting, however, for the greater part of encrinites and corallites, which exist in a mineralized state in different parts of the world, imbedded at considerable depths and at the utmost elevations in some of the loftiest limestone mountains : Bituminized fossil wood, approaching in its gradations to jet,

and somewhat intermediate between vegetable matter and pit-coal, discovered in the neighbourhood of the Rhine, in some parts of England, and at Bay Macrevan in the County of Antrim; traces of an ancient forest, discovered beneath a peat-bog on the shore of Belfast Lough; also hazel-nuts found in the same place, of which many of the kernels are converted into calcareous spar, the shells remaining unaltered: forests of semi-bituminized trees, viz.—deal, oak, and yew, lying at various depths in a great many of the bogs throughout Ireland: the existence in many coal mines of vertical trunks of trees, rising up through the several strata of rocks that enclose them; a family of tropical plants, recently exposed to view by the exploitation of some of the freestone quarries of the Isle of Portland; a forest of the trunks of palm-trees, ascertained to lie buried at Causladt and Tonna on the Necker, where numerous bones of the deluvian elephant, rhinoceros, hippopotamus, horse and ox, are promiscuously entombed: many mineralized fruits, appertaining to monocotylidinous and polycotylidinous families, especially those of the palm, detected in the upper strata of pit-coal in many parts of Europe, where no species of those trees would now naturally grow: multitudinous beautiful impressions of ferns, flags, and mosses found in coal-formations and engraved on the tablets of calcareous slate: organized and well-preserved vegetable substances, such as the mosses and aquatic confervæ often seen in agates; pieces of jointed bamboo found filled, some with white quartz in a stratum of soft red sand-stone, near the sea in Somersetshire: the discovery made in the clay stratum at Sheppey, of a prodigious quantity of fruit or ligneous seed-vessels, seven hundred specimens of which were selected by Mr. Francis Crow, none among them being duplicates, and very few agreeing with any known seed-vessels: various vegetable remains, especially of the arborescent ferns, reported by Captain Parry to lie encased in Melville Island, near the north-pole, in the same kind of coal-sand stones that retain the impressions of these vegetables in more southern latitudes; a large deposit of fossil plants presenting many varieties hitherto unknown, discovered not long ago in a pseudo coal-field at Gristhorpe bay in Yorkshire, all extended in horizontal strata, those of the same species being together, and a considerable proportion of them being congeneric with many now existing in tropical regions; some of the specimens, particularly the felices, being perfectly pliant and combustible.

All these phenomena of the relics of animals and vegetables of former times, connected with the geological evidence of corresponding alterations of the mineral kingdom, manifestly record the antique revolutions of our globe, and its inundation by the ocean. They also prove that the climate of the Arctic regions was originally nearly as warm and genial as that of the tropics and equator; and that there were in being numerous species, and even genera of animals and vegetables, which became extinct by the catastrophe of the deluge.

It is remarkable, that no human skeleton, belonging to the ancient world, has been discovered; a circumstance the more surprising, as the mighty men of old were of gigantic stature and strength, and their bones were large, firm, hard, and as capable of durability as any other osseous matter could be—and they would be readily recognized by all anatomists. Their non-appearance hitherto, admits of a natural or rational explanation only by supposing that the human population, then considerably less numerous than that of the brute creation, was confined to Assyria and Armenia, and the neighbouring eastern countries, and that no great number of well-conducted or extended geological ob-

servations of these regions have yet been made. Or this problem might be solved by reference to a supernatural cause, on the hypothesis that the Almighty Sovereign of the universe, incensed against his human creatures for their great iniquities, and resolved on their destruction, decreed, at the epoch of the diluvium, a final general judgment on the bodies as well as on the souls of all mankind—save Noah and his family, who found grace before him—and consigned both natures at once to the same eternal doom.

Mr. Kirwan discourses in his third essay on what he terms, “The Subsequent Catastrophes of the Globe,” namely—the separation of both continents; the insulations of Sicily, Sardinia, Corsica, part of Greece, Britain, Ireland, and many other countries. These excavations are supposed by him to have occurred at least 3600 years ago, and to have been the consequences of volcanic excavations. He rejects the assertion of Count Borch, who pretends that *Ætna* is at least 8000 years old; an assertion which Kirwan could not have allowed to pass unproved, as it militates against the credit of the Mosaic history. He writes on the point of controversy as follows:—“Count Borch, in his letters on Sicily and Malta, infers that *Ætna* is at least 8000 years old, from the beds of vegetable earth which he discovered between beds of lava; yet Dolomieu expressly tells us that such strata of earth do not exist between beds of lava. Even if that were found there, yet no conclusion relative to the age of the lava could fairly be deduced from that circumstance, as some lavas become fertile much sooner than others. Thus chevalier Givanni in 1787 found lavas projected in 1766 in a state of vegetation; while other lavas much more ancient still remained barren. (Dolom. Ponces. 493.) And in particular,” continues Kirwan, “it is well known that beds of volcanic ashes and pumice vegetate sooner than any others. Domolieu tells us that Canon Recupero denied having ever expressed any doubt on that head.”*

This work bears honourable testimony to the intellect and erudition of its author, especially if due allowance be made for the time at which it was composed, and for the state of science at that period. It was,

* Mr. Brydome, in his *Tour through Italy and Malta*, describes a pit of great depth sunk near to Jaci, and says, “They pierced through seven distinct lavas, one under the other, the surfaces of which were parallel, and most of them covered with a thick bed of rich earth. Recupero has made use of this as an argument to prove the great antiquity of the eruptions of this mountain. For if it requires two thousand years or upwards to form but a scanty soil on the surface of a lava, there must have been more than that space of time betwixt each of the eruptions which have formed these strata; and consequently the lowest of these lavas must have flowed from the mountain at least 14000 years ago.” In reply to this sort of argumentation, which is still repeated by some persons in different parts of Europe, and which I have heard particularly insisted on by a professor of geology on the Continent, I not only refer to what Mr. Kirwan says in the article above quoted, but shall in a few words abstract the substance of a page from a learned memoir of Mr. Desmarest, of the French Institute. “The naturalist who pretended to establish the chronology of the history of the world, on the system of thirteen alternate beds of compact lavas and of burned earth, found in the accumulated volcanic matter of Mount *Ætna*, did not attend to this circumstance, that the terreous matter was not the product of the decomposition of the lava by the action of air and water, but the result of scoria, burnt earth, and agglomerated ashes, which accompanied the lavas in their currents, or were hurried along by them. He undoubtedly was not aware that these substances, in a state of imperfect fusion, are in reality only frit, which becomes vegetable earth—such as is seen abundantly formed in less than twenty years on the hills of Vesuvius, where the vine is cultivated. But the case is different with respect to the solid, central parts of these currents that remain undiminished and uninjured in the midst of the pulverised clay and scorice by which they are enveloped.” *Memoires de Mathematiques et de Physique de l’Institut*. Tom. VI. p. 219.

however, criticised with unseemly asperity, and an over-lofty tone of triumph, by Mr. Playfair, a very distinguished professor of mathematics in the university of Edinburgh, as if there were no difficulty in the adoption of his fond Huttonian creed, or no objection to some of the fictions of cosmogony of his school, which supposed a transposition of the loftiest mountains to the depths of the ocean, and attributed the formation of the widest valleys to the erosion of streamlets. Notwithstanding some very objectionable points in the theory of Dr. Hutton, it is generally allowed that he and his illustrator displayed great ingenuity and learning in their celebrated system relative to the ruins of a former world, the subsequent consolidation of the strata of this globe, and their elevation and inflection by the means of subterraneous heat under the bed of the ocean—a system ably supported by the theory of increased pressure.

There is a geological fact of importance which merits a place here. It is related by different modern circumnavigators, that in the South sea and Indian ocean, there are shores and islands recently formed, and others actually in a state of formation and emergency, which are composed of zoophytes and testacea. Barbadoes is likewise known to consist in a great part of fossil madrepores.

Some time previous to the publication of these essays, Mr. Kirwan read before the Royal Irish Academy, “a description of a new anemometer ;” wherein the force of wind, to which the degrees of its velocity are proportional, is measured by that of gravity, indicated in pounds and parts of a pound avoirdupois. The calculation is grounded on the observations of Mr. Smeaton in the Philosophical Transactions, vol. li.—Formulas are furnished applicable to the computation of a ship’s way ; and annexed is an interesting drawing of his anemometer, which is represented as being also fit to answer the purpose of an anemoscope. In the year 1800, he added four papers to the stock of the Academy, namely :—First, his “Observations on the Proofs of the Huttonian Theory of the Earth,” adduced by Sir James Hall, Bart. Second, his “Essay on the Declivities of Mountains,” which, like the entire of his productions, is well entitled to praise. Third, his “Illustration and Confirmation of some facts mentioned in an Essay on the Primitive State of the Globe.” The fourth is his “Essay on Chemical and Mineralogical Nomenclature.” In our Author’s strictures on some parts of the French chemical nomenclature, he is less happy than usual. It was, however, natural enough for a man of his age, and of his time, to be partial to the chemical language to which he was habituated since his youth, in his intercourse with Bergman, Scheele, Macquer, Priestley, Black, and Cavendish. Nor is it surprising, that a person gifted as Kirwan was, should have proposed alterations in the names of a few matters in that science which he cultivated and advanced with so much honour to himself. And, for the credit of his memory, let it not be forgotten, that neither these substitutions, nor his general predilection for the nomenclature of the old school, dissuaded him from admitting some of the French terms which he deemed appropriate and necessary ; nor did they prevent him from adopting all the well-confirmed new discoveries, and availing himself of them in his experiments and writings. As to the mineralogical nomenclature, he alleges his reasons for preferring, in most cases, the denominations employed by his favourite Werner, to those of Abbé Haüy.